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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/737,642	12/14/2000	Daniel C. Wang	ACT-311	2280

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EXAMINER

DIAZ, JOSE R

ART UNIT

PAPER NUMBER

2815

DATE MAILED: 01/31/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/737,642

Applicant(s)

WANG, DANIEL C.

Examiner

José R. Díaz

Art Unit

2815

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 14 December 2000.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-10 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 December 2000 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 2. 6) ☐ Other: _____

DETAILED ACTION

Drawings

➤ The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference character "58" has been used to designate both "a masking layer" and "the upper Cu metal layer". A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Objections

- Claims 1 and 10 are objected to because of the following informalities:
- The term "An upper barrier layer" should be changed to --an upper barrier layer--.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

- The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

➤ Claim 6 is rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. The limitation wherein the first and second cap layers are formed from TiN is not supported by Applicant's Specification. For instance, see page 8, lines 15-16 and page 10, lines 15-16, wherein

Applicant discloses that the cap layers are formed of SiN and not of TiN. Applicant only uses the TiN material as barrier metal layers (see for example page 10, lines 6-7).

Clarification is required.

Claim Rejections - 35 USC § 102

➤ The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in-

(1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or

(2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

➤ Claims 1, 3-5 and 10 are rejected under 35 U.S.C. 102(e) as being anticipated by Shao et al. (US Patent No. 6,124,194).

Regarding claims 1 and 10, Shao et al. teach an antifuse (see cols. 1-6) comprising: a lower insulating layer (20); a lower Cu metal layer (26); a lower barrier layer (36); an antifuse material layer (38); an upper barrier layer (44); an upper insulating layer (46); and an upper Cu metal layer (56) (see Fig. 4).

Regarding claim 3, Shao et al. teach that the antifuse material comprises amorphous silicon (see col. 3, lines 16-20).

Regarding claim 4, Shao et al. teach that the lower barrier layer comprises TaN (see col. 3, lines 16-20).

Regarding claim 5, Shao et al. teach that the upper barrier layer comprises TiN (see col. 3, lines 16-20).

Claim Rejections - 35 USC § 103

➤ The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

➤ Claims 2 and 6-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shao et al. (US Patent No. 6,124,194) in view of Yeouchung et al. (US Patent No. 6,001,693).

Regarding claim 2, Shao et al. teach that the antifuse further comprises a first and a second cap (28) (see Fig. 4 and col. 3, lines 1-5). However, Shao et al. fails to teach that the second cap layer envelopes the antifuse material and the upper barrier layer. Yeouchung et al. teach that is well known in the art to envelope the antifuse material (22) and the upper barrier layer (24) with a cap layer (40, 42) (see Fig. 10 and col. 3, lines 17-23). Therefore, it would have been obvious to one having ordinary skill in the art at the same time the invention was made to modify Shao et al. to include the limitation of enveloping the antifuse material and the upper barrier layer with a second cap layer. The ordinary artisan would have been motivated to modify Shao et al. in the manner described above for at least the purpose of reducing side diffusion associated with the top electrode or upper metal layer.

Regarding claim 6, Shao et al. teach that the first and second cap layer comprises nitride (see col. 3, lines 3-4).

Regarding claim 7, Shao et al. teach that the antifuse material comprises amorphous silicon (see col. 3, lines 16-20).

Regarding claim 8, Shao et al. teach that the lower barrier layer comprises TaN (see col. 3, lines 16-20).

Regarding claim 9, Shao et al. teach that the upper barrier layer comprises TiN (see col. 3, lines 16-20).

Conclusion

➤ The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Takagi et al. (US Pat. No. 5,866,938) disclose an antifuse material covered with a dielectric (4). Hawley et al. (US Pat. No. 6,124,193) disclose the use of the spacers (32) to cover the antifuse material.

Correspondence

Any inquiry concerning this communication or earlier communications from the examiner should be directed to José R. Díaz whose telephone number is (703) 308-6078. The examiner can normally be reached on 9:00 - 5:00 Monday through Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C. Lee can be reached on (703) 308-1690. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 746-3891 for After Final communications.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

JRD
January 27, 2002

A handwritten signature in black ink, appearing to read 'Eddie Lee', with a large, sweeping initial 'E'.

EDDIE LEE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800